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Incentivising pro-circular behaviours: proposing a new enhanced capital allowance scheme for remanufactured products - the case of refrigerated display cabinets in the United Kingdom

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Abstract

A number of behavioural barriers are preventing the development of a Circular Economy in the retail refrigeration sector and it is possible, that financial incentives could help to overcome them. Using Refrigerated Display Cabinets as an example, this paper aims to encourage dialogue between manufacturers and policymakers about developing a new Enhanced Capital Allowance eligibility scheme for a variety of remanufactured product groups. This could be pivotal in encouraging the industry to become more resource-efficient and pro-circular.

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1. Introduction

Refrigerated Display Cabinets are used to stock and display chilled, frozen food and beverages in retail grocery stores. Cabinets commonly remain in use for 5 years (first lifecycle) before being disposed of and replaced by new units. Some businesses take a resource efficient approach by cosmetically refurbishing their Refrigerated Display Cabinets. However, there is potential for a cabinet to remain in use for as long as 15 years across 3 life-cycles [1]. This is providing they are originally manufactured to a good standard, more extensively refurbished at the end of their first lifecycle and remanufactured at the end of their second lifecycle. Remanufacture however, is seldom practiced in the retail refrigeration industry. It has the potential to be a driver of the Circular Economy and a key strategy in ensuring cabinets reach their maximum utility and lifespan.

The Circular Economy model is underpinned by a variety of theories and disciplines that aim to reduce waste and raw material consumption in the manufacturing process. The manufacture of cabinets is typified by the extensive use of materials and energy, meaning that the development of a Circular Economy in this sector is particularly important. Despite the economic and environmental benefits of remanufacture, the Circular Economy still remains underdeveloped in the retail refrigeration industry. This is illustrated by the amount of waste generated, for example the latest figures show that in 2015 over 68,833 remanufacturable cabinets were disposed and replaced by new units [2].

Fiscal incentives could help prevent the number of Refrigerated Display Cabinets from entering the waste-stream. At present the UK Government uses the Enhanced Capital Allowance (ECA) scheme to incentivise the purchase of sustainable products. The Enhanced Capital Allowance scheme was introduced in 2001 to encourage businesses to reduce resource consumption by procuring and using both energy-saving and water-efficient products. In the retail refrigeration sector, the scheme is known to support the purchase of new environmentally friendly Refrigerated Display Cabinets on the Government's Energy Technology List (ETL). With the scheme incentivising the purchase of new products only, remanufactured cabinets that could similarly help businesses reduce resource consumption are excluded from it.

The Enhanced Capital Allowance scheme has the potential to make the manufacturing sector more resource efficient. This paper proposes the extension of the scheme to include a standard to make remanufactured Refrigerated Display Cabinets compliant under the Enhanced Capital Allowance scheme.

2. Remanufacture of Refrigerated Display Cabinets (RDCs)

The Centre for Remanufacturing and Reuse (CRR) predicts that in 2015 there were approximately 832,000 Refrigerated Display Cabinets in UK grocery stores and that only 12,147 out of 80,980 end-of-life Refrigerated Display Cabinets were reused [2]. Based on these estimates over 68,000 potentially remanufacturable units entered the waste stream.

There has been very little focus on sustainable innovation in food refrigeration since the introduction of Refrigerated Display Cabinets in the 1930s. As a result, the design of cabinets has not changed very much throughout the past decades. The redesign of Refrigerated Display Cabinets with future remanufacture in mind is key to prolonging their lifespans. Should manufacturers take an approach to design that emphasises easy-disassembly, long-life materials and components, then less cabinets will be subject to disposal. This however is equally dependent on product owners showing an inclination to remanufacture and being aware of the economic and environmental benefits of the approach.

Part of this can be achieved through educating product owners on what the remanufacturing process entails and differentiating it from refurbishment. Muranko et al. [3] define the remanufacturing of Refrigerated Display Cabinets as: "A process of manufacturing finished goods that meet a customer's expectations or specifications, where at least 50% of the materials and components are sourced from the core of end-of-life product(s). As a result an end-of-life product (cabinet) is returned to a "good-as-new" or better state, with a warranty equivalent to that given for a new product (cabinet). The process of remanufacturing always takes place in an industrial set up, where a division of labour supports a large scale manufacture". It is important to emphasise that remanufactured cabinets are starting a lifecycle

as a new product after they leave manufacturers site. In addition, remanufacturing can prevent a series of steps that are involved when disposing a cabinet. Examples are the transportation, shredding, material separation and regeneration for manufacture. These steps are typically very expensive and energy-intensive. Research shows that if remanufacturing was practised across the entire retail refrigeration sector, 144,000 tonnes of (embodied) CO₂ emissions would be cut annually [2].

3. Developing a Circular Economy through the Enhanced Capital Allowance (ECA) Scheme

The UK Government “recognises the importance of moving to a more sustainable economy” [4]. In the recently published Green Paper [5] the Government calls for UK businesses to be more resource efficient and emphasises the need for more research into “how energy costs can be contained or reduced by increasing resource and energy productivity” across the manufacturing supply chain [5]. As a result the Government intends to explore “disruptive business models that challenge inefficient practice” in an attempt “to reduce raw material demand... [and] promote [the use] of secondary materials” [5]. Remanufacturing is one such model that, if included in the Enhanced Capital Allowance, can lead to a well-functioning, sustainable refrigeration market that at a higher level helps the Government reach its Industrial Strategy goals.

3.1. Incentivising purchase of environmentally friendly products through the Enhanced Capital Allowance Scheme

The Enhanced Capital Allowance scheme was introduced in 2001 to encourage businesses to invest in energy-saving and water-efficient plant and machinery by reducing their capital cost. The scheme works by incentivising those who purchase a product from the Energy Technology or Water Technology List the opportunity to claim back 100% of the corporation tax paid on the product [6]. Products that feature on this list, such as boilers, compressors, electric motors and lighting, typically sit at the more expensive end of the market due to having the latest technologies. As a result the scheme makes resource efficient products more affordable by reducing their overall cost.

The original aim of the Enhanced Capital Allowance scheme was to promote operational resource efficiency. However, the inclusion of Enhanced Capital Allowance compliant remanufactured products would help widen its impact in promoting embodied resource efficiency too. This is due to remanufacturing process that typically utilises at least 50% of the core components from an end-of-life Refrigerated Display Cabinets when manufacturing new products.

3.2. Incentivising pro-circular behaviours (P-CBs) in the retail refrigeration industry

Pro-circular behaviour is a specific type of a behaviour that supports the development of a Circular Economy. It can be defined as: an action which is brought about due to prioritising resource-efficiency. This behaviour benefits or at least reduces damage to the environment, economy and society. In the retail refrigeration sector, behaviours such as producing remanufactured Refrigerated Display Cabinets and purchasing remanufactured cabinets are considered as pro-circular.

The Enhanced Capital Allowance helps to transform the energy-efficiency market [6]. There is an opportunity for the scheme to incentivise purchase of remanufactured products such as Refrigerated Display Cabinets and encourage pro-circular behaviours in the retail refrigeration industry. According to the Centre for Remanufacturing and Reuse [2], those who purchase retail refrigeration equipment are extremely price sensitive and follow the mantra that “cheapest is the best”. With price and quality of products often being key factors influencing purchase, a financial discount and quality standard could drive demand for remanufactured cabinets.

The behaviours related to the remanufacture of Refrigerated Display Cabinets can have a substantial impact on the environment, economy and society. These include:

- Reducing waste, air and soil pollution, for example: 70% of a cabinets body is made with steel. Reusing steel is significantly more environmentally friendly than using virgin steel, despite it typically having 60% recycled content. In fact the production of virgin steel has 96% more of an environmental impact [7]. The reuse of steel can avoid mineral extraction, fossil fuel depletion, toxicity to water, toxicity to air and climate change [7].

- Supporting more training and job opportunities, for example: the creation of a new remanufacturing market in the UK retail refrigeration industry is a possible job creation opportunity. Latest figures show there is an estimated 1.6 million people unemployed in the UK [8]. According to Walsh [2] 3,050 new jobs could be created to annually remanufacture 58,000 cabinets. Therefore, there is scope for manufacturers to train (e.g. apprentices) and hire more staff (temporary and permanent) should the retail refrigeration industry become more pro-circular in their behaviour and therefore demand more remanufactured cabinets.
- Supporting growth of local businesses, for example: UK retailers spent £69.5 million on importing new Refrigerated Display Cabinets from outside the UK, in 2016 [9]. This is equivalent to approximately 255,000 cabinets. However with scope for the UK to make approximately 81,000 cabinets available through refurbishment and remanufacture in 2015 [2], over a third of these imports could have been sourced within the UK Market, thereby fuelling the national economy.

3.3. Proposing the extended Enhanced Capital Allowance scheme for remanufactured Refrigerated Display Cabinets

In 2008, the Centre for Remanufacture and Reuse met with Department for Environment, Food and Rural Affairs, the Carbon Trust and HM Revenue and Customs to discuss making remanufactured products eligible for subsidies under the Enhanced Capital Allowance scheme [10]. It was suggested that to do this the Government would require evidence that remanufacturing adhered to a “stringent standard”. This ambiguity may infer that the Government has concerns over the quality or performance of remanufactured products. As stated above, this concern is mitigated by the fact that remanufactured products come with a warranty and are categorised “as good as new”. Currently however remanufactured energy-efficient products are not included on the Energy Technology List.

Currently, Refrigerated Display Cabinets listed on the Energy Technology List that are eligible for the Enhanced Capital Allowance scheme must:

- “Be designed to display chilled and/or frozen foodstuffs, whilst maintaining them within prescribed temperature limits.”
- “Conform to one of the temperature classifications... when tested to BS EN ISO 23953-2:2005+A1:2012 in climate class III (25°C, 60% RH)”.
- “Be classified in accordance with the precise 5 digit classification system set out in Annex A of BS EN ISO 23953-1:2005 +A1:2012”
- “Be CE marked.” [11]

Eligible Refrigerated Display Cabinets must also comply with specific Performance Criteria. They must meet:

- Temperature classifications (including M0, M1, M2), category (remote or integral) and configuration (horizontal or vertical)
- Energy Efficiency Index (EEI) equivalent to the proportion of cabinet’s Total Energy Consumption (TEC) and Total Display Area (TDA)
- Test Procedures which must be verified by an independent body

An example of a new product that meets the criteria above is the Eco Dallas 100 remote Refrigerated Display Cabinet. However, a remanufactured Eco Dallas 100 unit built to the same specifications can also be shown to meet all of the above criteria. This paper proposes extending the Enhanced Capital Allowance Eligibility Criteria to make remanufactured Refrigerated Display Cabinets eligible. As a prerequisite, remanufactured cabinets should meet specific material efficiencies (A) and adhere to a remanufacturing standard (B).

3.3.1. Fulfillment of specific material efficiencies

On average over 90% of a cabinets body is made from reusable and long life materials. Table 1 presents the materials used in the production of a typical new 1.25m remote Refrigerated Display Cabinet and shows the proportion of materials that can be reused from its second lifecycle (after 10 years) for remanufacture. The figures used in the table are estimates based on current industry practice.

The majority of reusable components are made of steel which accounts for 70% of the cabinet body. Typically, a 1000 kg of reused steel can save 1800 kg of CO₂ emissions [12]. This means that the remanufacture of this cabinet can save between 340 kg and 573 kg of CO₂e from steel reuse alone.

Further analysis of different Refrigerated Display Cabinet models that are currently listed on the Energy Technology List could help establish a catalogue of material efficiencies.

Table 1. Materials used in the manufacture of a typical 1.25m remote Refrigerated Display Cabinet (RDC) and range of materials usually reused in the remanufacture of a 10 year old equivalent unit.

Material	New RDC Content	Minimum and maximum reused content in remanufactured RDC
Galvanised steel	277.5 kg	47% - 87%
Stainless steel	77.68 kg	74% - 100%
Polyurethane	27.6 kg	Rarely 0% – usually 100%
MDF	44.8 kg	80% - 100%
Glass	44 kg	Rarely 0% - usually 100%
Copper	11.5 kg	Rarely 0% - usually 100%
Aluminium	18.2 kg	33% - 100%

3.3.2. Subscription to manufacturing standards

An industry wide standard that sets quality and manufacturing guidelines for Remanufactured Enhanced Capital Allowance compliant Refrigerated Display Cabinets could help educate, reassure and improve consumer perception of remanufactured products. Having a more informed consumer could lead to an increase in demand for remanufactured products and help develop the Circular Economy.

As a first step to developing this standard we can look at benchmarking the British Standards Institution's remanufacturing standard. Remanufactured cabinets are required to be produced in line with the BS 8887-1:2006 [13], BS8887-2:2009 [14] and BS 8887-220:2010 [15]. These relate to:

- design methodologies
- technical product specification for the manufacture, assembly, disassembly and end-of-life processing
- guidance on the reuse, recovery, recycling and disposal
- definitions of remanufacture, carbon footprint, end-of-life, reuse and recondition
- remanufacturing process

In order to create a comprehensive standard that aims to standardise the process of remanufacture, authors of this paper suggest adding the following:

- treatment methodologies on the end-of-life components used in remanufacture of specific products
- product-specific remanufacturing methodologies (including disassembly, manufacture, remanufacture and assembly)
- guidance on testing and quality assurance

4. Discussion

The ETL lists a variety of products that have a capability to be remanufactured. This includes such as boilers, electric motors, compressors, condensers, air conditioning and other refrigeration systems. This paper aims to encourage dialogue between manufacturers and policymakers about developing a new product specific material-efficiency criteria and remanufacturing standards for the new scheme. This could be pivotal in encouraging the industry to become more resource-efficient and pro-circular.

5. Conclusions

The extension of the Enhanced Capital Allowance scheme could act as a regulatory and financial instrument that drives the development of a Circular Economy. Proposing a new specific industry standard for material-efficiencies and processes for the Remanufactured Enhanced Capital Allowance Complaint Products could help to facilitate this. The Enhanced Capital Allowance scheme could support pro-circular behaviours by incentivising purchase of energy-efficient and resource-efficient remanufactured products.

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